

INCH-POUND

O-G-491D

May 1, 1992

SUPERSEDING

O-G-491C

October 12, 1984

## FEDERAL SPECIFICATION

### GLYCEROL, TECHNICAL (HIGH GRAVITY)

*This specification is approved by the Commissioner of Federal Supply Service, General Services Administration, for use by all Federal agencies.*

#### 1. SCOPE

1.1 **Scope.** This specification covers one grade of glycerol, also known as high-gravity glycerin.

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

##### Federal Specifications:

|            |  |
|------------|--|
| TT-E-485   | - Enamel, Semi-Gloss, Rust-Inhibiting                        |
| PPP-B-585  | - Boxes, Wood, Wirebound                                     |
| PPP-B-621  | - Boxes, Wood, Nailed and Lock-Corner                        |
| PPP-B-636  | - Boxes, Shipping, Fiberboard                                |
| PPP-C-96   | - Cans, Metal, 28 Gauge and Lighter                          |
| PPP-C-2020 | - Chemicals, Liquid, Dry, and Paste: Packaging of            |
| PPP-D-729  | - Drums, Shipping and Storage, Steel, 55-Gallon (208 Liters) |

Comments or suggestions pertaining to this specification should be addressed to: Commander, U.S. Army Chemical Research, Development and Engineering Center, ATTN: SMCCR-PET-S, Aberdeen Proving Ground, MD 21010-5423.

AMSC N/A

FSC 6810

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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PPP-F-320 - Fiberboard: Corrugated and Solid, Sheet Stock (Container Grade) and Cut Shapes

**Federal Standards:**

Fed. Std. No. 123 - Marking for Shipment (Civil Agencies)  
 FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities  
 FED-STD-595 - Colors Used in Government Procurement

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification, other Federal specifications, and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Washington, DC; Philadelphia, PA; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Auburn, WA.

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies.)

**Military Specifications:**

MIL-P-15011 - Pallets, Material Handling, Wood Post Construction, 4-Way Entry

**Military Standards:**

MIL-STD-129 - Marking for Shipment and Storage  
 MIL-STD-147 - Palletized Unit Loads  
 MIL-STD-1168 - Ammunition Lot Numbering

(Copies of military specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

**2.2 Other publications.** The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

**ASTM Standards:**

- D 1193 - Reagent Water
- D 1258 - Testing High-Gravity Glycerin
- D 3951 - Commercial Packaging

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

**National Motor Freight Traffic Association, Inc., Agent**

“National Motor Freight Classification”

(Application for copies should be addressed to the American Trucking Associations, Inc., Traffic Department, 1616 P Street, NW, Washington, DC 20036.)

**Uniform Classification Committee, Agent**

“Uniform Freight Classification”

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

**2.3 Order of precedence.** In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### **3. REQUIREMENTS**

**3.1 Physical and chemical characteristics.** Glycerol shall conform to the physical and chemical characteristics of table I when tested as specified therein.

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TABLE I. Physical and chemical characteristics

| Characteristic                                     | Requirement                         | Test paragraph |
|--|-------------------------------------|----------------|
| Appearance   | Clear and free of suspended matter  | 4.2.4.1        |
| Odor   | Slight, characteristic              | 4.2.4.1        |
| Color, Pt-Co max                                   | 20                                  | 4.2.4.1        |
| Specific gravity at 25 °/25 ° C                    | Not less than 1.2587                | 4.2.4.1        |
| Acidity or alkalinity                              | To pass test                        | 4.2.4.2        |
| Ash, percent by weight, max                        | 0.10                                | 4.2.4.3        |
| Chlorides calculated as Cl, percent by weight, max | 0.01                                | 4.2.4.4        |
| Saponification equivalent, percent by weight, max  | 0.05                                | 4.2.4.5        |
| Silver nitrate precipitation                       | No precipitate formed in 10 minutes | 4.2.4.6        |

**3.2 Material Safety Data Sheets.** Material Safety Data Sheets for glycerol shall be prepared and submitted by the contractor in accordance with FED-STD-313 (see 6.3).

#### 4. QUALITY ASSURANCE PROVISIONS

**4.1 Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

**4.1.1 Responsibility for compliance.** All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

**4.1.2 Contractor assurance of compliance.** The contractor's quality program or detailed inspection system shall provide assurance of compliance of all characteristics with the applicable specification requirements using, as a minimum, the conformance criteria specified herein.

**4.1.3 Alternative inspection provisions.** Alternative inspection procedures, methods, or equipment, such as statistical process control, tool control, and other types of sampling procedures may be used by the contractor when they provide, as a minimum, the level of quality assurance required by the inspection provisions specified herein. Prior to applying such alternative procedures, methods, or equipment, the contractor shall describe them in a written proposal submitted to the Government for evaluation and approval. (See 6.4.) When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the quality assurance provisions specified herein. In cases of dispute as to whether the contractor's proposed alternative provides equal quality assurance, the provisions of this specification shall apply. All approved alternative inspection provisions shall be specifically incorporated into the contractor's quality program or detailed inspection system, as applicable.

## **4.2 Quality conformance inspection.**

**4.2.1 Lotting.** A lot shall consist of the glycerol produced by one manufacturer, at one plant, from the same materials, and under essentially the same manufacturing conditions provided the operation is continuous. In the event the process is a batch operation, each batch shall constitute a lot (see 6.5). When specified (see 6.2), lot numbering shall be in accordance with MIL-STD-1168.

### **4.2.2 Sampling.**

**4.2.2.1 For examination of packaging.** Sampling shall be conducted in accordance with table II. The sample unit shall be one filled unit pack or packing container, as applicable, ready for shipment.

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**TABLE II. Sampling for packaging examination and test**

| Number of containers in batch or lot | Number of sample containers |
|--------------------------------------|-----------------------------|
| 1 or 2                               | all                         |
| 3 to 25                              | 3                           |
| 26 to 50                             | 5                           |
| 51 to 90                             | 6                           |
| 91 to 150                            | 7                           |
| 151 to 280                           | 10                          |
| 281 to 500                           | 11                          |
| 501 to 1,200                         | 15                          |
| 1,201 to 3,200                       | 18                          |
| 3,201 to 10,000                      | 22                          |
| over 10,000                          | 29                          |

**4.2.2.2 For glycerol test.** See 6.6 for sampling and testing precautions. Sampling shall be conducted in accordance with table III. A representative specimen of approximately 2 liters shall be removed from each sample container and placed in a suitable clean, dry container labeled to identify the lot and container from which it was taken.

**TABLE III. Sampling for glycerol test**

| Number of containers in batch or lot | Number of sample containers |
|--------------------------------------|-----------------------------|
| 1 or 2                               | all                         |
| 3 to 25                              | 2                           |
| 26 to 150                            | 3                           |
| 151 to 1,200                         | 5                           |
| 1,201 to 7,000                       | 8                           |
| 7,001 to 20,000                      | 10                          |
| Over 20,000                          | 20                          |

**4.2.2.3 For container leakage test.** Sampling shall be conducted in accordance with table II. The sample unit shall be one container.

### 4.2.3 Inspection procedure.

**4.2.3.1 For examination of packaging.** Sample unit packs and packing containers shall be examined for the characteristics listed below. Failure of any sample unit pack or packing container to conform to all characteristics shall be cause for rejection of the lot represented.

- (a) Contents per container
- (b) Container
- (c) Container closure
- (d) Container free of damage and leaks
- (e) Fiberboard liners, partitions, or pads evident, correct, and correctly placed, or as specified (when required)
- (f) Container coating evident and correct, or as specified (when required)
- (g) Marking evident, correct, and legible
- (h) Unitization

**4.2.3.2 For glycerol test.** See 6.6 for sampling and testing precautions. Each sample specimen taken in 4.2.2.2 shall be tested as specified in 4.2.4. Failure of any test by any specimen shall be cause for rejection of the lot represented.

**4.2.3.3 For container leakage test.** The sample containers selected in 4.2.2.3 shall be tested as specified in 4.2.5. Failure of any test by any container shall be cause for rejection of the lot represented.

**4.2.4 Glycerol tests.** Water in accordance with ASTM D 1193 and reagent grade chemicals shall be used throughout the tests. Where applicable, blank determinations shall be run and corrections applied where significant. Tests shall be conducted as follows:

**4.2.4.1 Appearance, odor, color, and specific gravity.** Determine in accordance with the applicable test procedure in ASTM D 1258.

**4.2.4.2 Acidity or alkalinity.** Measure 50 milliliters (mL) of the specimen in a 50-mL graduated cylinder and pour into a 200-mL Erlenmeyer flask. Rinse the graduated cylinder with 100 mL of carbon dioxide-free water that has been rendered exactly neutral to phenolphthalein indicator and pour the rinsings into the flask containing the specimen. Titrate the glycerol solution to neutrality with 0.5 *N* hydrochloric acid (HCl) or 0.5 *N* sodium hydroxide solution (NaOH), as required, using phenolphthalein indicator. Multiply the number of mL required by the normality of the solution used and report the product as mL of normal solution required for 50 mL of the specimen. To pass the test, 50 mL of specimen shall require not more than 0.30 mL of 1 *N* HCl or of 1 *N* NaOH for neutralization.

**4.2.4.3 Ash.** Determine the ash content of the specimen in accordance with the sulfate ash procedure in ASTM D 1258. Retain the residue for the chloride determination (see 4.2.4.4).

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**4.2.4.4 Chlorides, calculated as Cl.** Add about 25 mL of hot water to the ash residue obtained in 4.2.4.3 and rub with the flattened end of a stirring rod. Add 1 mL of a solution made by dissolving 10 gram (g) of potassium chromate in 100 mL of water and titrate with 0.01 N silver nitrate solution to the first permanent reddish tint. Run a blank and calculate the percent by weight total chlorides present as follows:

$$\text{Percent total chlorides} = \frac{3.546 \text{ VN}}{W}$$

where V = Volume of standard silver nitrate solution (corrected for blank), in mL,  
 N = Normality of silver nitrate solution,  
 W = Weight of specimen used in 4.2.4.2, in g.

**4.2.4.5 Saponification equivalent.** Transfer a 25-g portion of the specimen to a 250-mL Erlenmeyer flask. Add 100 mL of freshly boiled water. Pipet 10 mL of 0.33 N NaOH into the flask. Attach the flask to a condenser and reflux the contents gently for 1 hour. Remove the flask and contents from the source of heat, allow the contents to cool to room temperature, and titrate the excess NaOH with 0.1 N HCl, using phenolphthalein as indicator. Run a blank. Calculate the saponification equivalent as percent by weight sodium oxide as follows:

$$\text{Saponification equivalent (as percent Na}_2\text{O)} = \frac{3.10 (A-B) N}{W}$$

where A = Volume of hydrochloric acid used for blank, in mL,  
 B = Volume of hydrochloric acid used for specimen, in mL,  
 N = Normality of hydrochloric acid solution,  
 W = Weight of specimen used, in g.

**4.2.4.6 Silver nitrate precipitation.** Pipet a 10-mL portion of the specimen to a 25-mL glass-stoppered cylinder and add exactly 10 mL of a 10.0 percent solution of silver nitrate. Mix the solution thoroughly by repeated inversion of the cylinder. (Note: The mixing operation should not be so vigorous as to produce a froth. Both the addition of the silver nitrate solution and the mixing operation should be done in subdued light.) Allow the solution to stand for 10 minutes and then examine the contents of the cylinder for the formation of a flocculent precipitate. If a flocculent precipitate (not to be confused with a finely divided precipitate of silver) is formed, the glycerol shall be considered as having failed this test. (If silver oxide precipitate forms, the specimen should be neutralized to pH 7.0 prior to testing.)



**4.2.5 Container leakage test.** Place the container in each of the following positions, and leave it in each for a period of 15 minutes.

- (a) Upright
- (b) Upside down
- (c) On one side (or one quadrant)
- (d) On one end (or second quadrant)
- (e) On other side (or fourth quadrant)

Examine the container after each period for any evidence of leakage.

## 5. PACKAGING

Note: The metric equivalents given for inch-pound quantities are nominal values provided for informational purposes and should not be considered as quantity requirements.

**5.1 Unit packing.** Glycerol shall be unit packed level A, B, or industrial, as specified (see 6.2), in accordance with the general requirements of PPP-C-2020.

**5.1.1 Level A.** Glycerol shall be unit packed level A in a 1- or 55-gallon (4.0- or 210.0-liter) quantity as specified (see 6.2).

**5.1.1.1 One-gallon (4.0-liter) quantity.** A quantity of 1 gallon (+1 or -0 fluid ounces) (4.0 liters) of glycerol shall be unit packed in a nominal 1-gallon (4.0-liter) capacity can conforming to type V, class 4, oblong, tin-plate of PPP-C-96. The can shall be formed from minimum number 100 electrolytic tin-plate, shall be furnished with a bridge type handle, and shall have exterior nonmetallic coating, plan B with side seam striped. The closure shall be in addition to an inner seal and shall be closed to a torque within the range specified by the can supplier. There shall be no evidence of leakage of contents when tested as specified in 4.2.5.

**5.1.1.2 Fifty-five-gallon (210.0-liter) quantity.** A quantity of 55 gallons (+1/2 or -0 gallons) (210.0 liters) of glycerol shall be unit packed level A in a nominal 55-gallon (210.0-liter) steel drum conforming to Rule 40 of the Uniform Freight Classification except that the entire interior surface of the drum shall be furnished with two coats of baked-on epoxy-phenolic enamel. The exterior shall be finished as specified for the type II drum of PPP-D-729, using olive drab enamel color No. 24087 of FED-STD-595, conforming to TT-E-485 or equal. Also, each plug on the drum shall be furnished with a cap-seal. The plugs shall be closed to a torque within the range specified by the drum manufacturer. There shall be no evidence of leakage of contents from the drum when tested as specified in 4.2.5.

**5.1.2 Level B.** Glycerol shall be packed level B in a 1- or 55-gallon (4.0- or 210.0-liter) quantity as specified (see 6.2).

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**5.1.2.1 One-gallon (4.0-liter) quantity.** The one-gallon (4.0-liter) quantity of glycerol shall be unit packed level B in the same manner as for level A protection in 5.1.1.1, except that no exterior nonmetallic coating shall be required.

**5.1.2.2 Fifty-five-gallon (210.0-liter) quantity.** The 55-gallon (210.0-liter) quantity of glycerol shall be unit packed level B in the same manner as for level A protection in 5.1.1.2, except that commercially acceptable exterior coating of the drum shall be acceptable.

**5.1.3 Industrial.** A specified quantity of glycerol (see 6.2) shall be unit packed in accordance with ASTM D 3951.

**5.2 Packing.** Glycerol shall be packed level A, B, or industrial as specified (see 6.2).

**5.2.1 Level A.** Glycerol shall be packed level A as four 1-gallon (4.0-liter) cans or a 55-gallon (210.0-liter) drum.

**5.2.1.1 One-gallon (4.0-liter) quantity.** Four 1-gallon (4.0-liter) cans of glycerol, unit packed as specified in 5.1, shall be packed level A in a close-fitting wirebound box. The box shall conform to class 3, style optional of PPP-B-585, with wood parts preserved as specified for the grade A box of PPP-B-621. All inside faces of the box shall be lined with fiberboard, and each can shall be placed in a close-fitting full-can-height cell formed from half-slotted partitions. Motion of contents shall be prevented by inserting fiberboard pads where needed. Liners, partitions, and pads shall be formed from fiberboard conforming to grade V3c of PPP-F-320. The box shall be closed as specified in PPP-B-585.

**5.2.1.2 Fifty-five-gallon (210.0-liter) quantity.** The 55-gallon (210.0-liter) quantity of glycerol, unit packed as specified in 5.1, shall require no further protection for shipment.

**5.2.2 Level B.** Glycerol shall be packed level B as four 1-gallon (4.0-liter) cans or a 55-gallon (210.0-liter) drum.

**5.2.2.1 One-gallon (4.0-liter) quantity.** The one-gallon (4.0-liter) quantity unit packs of glycerol shall be packed level B in the same manner as level A in 5.2.1.1, except that the box shall conform to weather-resistant grade V3c of PPP-B-636, and the box shall be reinforced after closure, in accordance with the appendix to PPP-B-636.

**5.2.2.2 Fifty-five-gallon (210.0-liter) quantity.** The 55-gallon (210.0-liter) quantity of glycerol, unit packed level B as specified in 5.1.1.2, shall require no further protection for shipment.

**5.2.3 Industrial.** Glycerol shall be packed industrially in accordance with ASTM D 3951.

**5.2.4 Palletization.** Uniform quantities of level A or B packs of the 1-gallon (4.0-liter) quantity of glycerol shall be palletized in accordance with load type I of MIL-STD-147 with

pallet conforming to type I of MIL-P-15011. Uniform quantities of industrial packs of glycerol shall be unitized in a manner to assure protection of the glycerol from the supply source to the initial destination, acceptance by common carrier, and conformance with Uniform Freight Classification Rules, National Motor Freight Classification Rules, or the rules applicable to any other intended mode of transportation.

### **5.3 Marking.**

**5.3.1 Civil agencies.** Marking shall be in accordance with Fed. Std. No. 123.

**5.3.2 Military activities.** Level A and B unit packs, packs and unitized loads shall be marked in accordance with MIL-STD-129. Industrial unit packs and packs shall be marked in accordance with ASTM D 3951. Industrial unitized loads shall be marked to show proper identification and to assure timely delivery from the supply source to the initial destination. In addition, each container shall be marked to show lot or batch number and date of manufacture of the glycerol.

## **6. NOTES**

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

**6.1 Intended use.** The glycerol covered by this specification is intended for use in the manufacture of explosives and in other industrial applications for which high-gravity glycerin is required.

**6.2 Acquisition requirements.** Acquisition documents must specify the following:

- (a) Title, number, and date of this specification
- (b) Level of unit packing and packing required (see 5.1 and 5.2)
- (c) Quantity to be unit packed level A, B, or industrially (see 5.1.1, 5.1.2, and 5.1.3)
- (d) If lot numbering in accordance with MIL-STD-1168 is required (see 4.2.1).

**6.3 Material Safety Data Sheets.** Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent mailing addresses for submissions of data are listed in FED-STD-313.

**6.4 Submission of alternative inspection provisions.** Proposed alternative inspection provisions should be submitted by the contractor to the procuring contracting officer for evaluation and approval by the technical activity responsible for preparation of this specification.

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**6.5 Batch.** A batch is defined as that quantity of material which has been manufactured by some unit chemical process or subjected to some physical mixing operation intended to make the final product substantially uniform.

**6.6 Sampling and testing precautions.** This specification requires inspection of chemical material which is potentially hazardous to personnel. This specification does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this specification to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. In addition, glycerol is a very hygroscopic material and precautions should be taken to prevent it from absorbing moisture from the atmosphere. If possible, sampling should be made in clear, dry weather.

**6.7 Significant places.** For the purpose of determining conformance with this specification, an observed or calculated value shall be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off method of ASTM E 29.

**6.8 Changes from previous issues.** Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

**6.9 Subject term (key word) listing.**

explosives  
glycerin

**MILITARY INTERESTS:**

**Custodians:**

Army - EA  
Air Force - 68

**Review activities:**

Army - MD, MI  
DLA - GS

**User activities:**

Navy - OS

**CIVIL AGENCY COORDINATING ACTIVITIES:**

GSA-FSS (9FTE-10)

**Preparing activity:**

Army - EA

Project No. 6810-1272

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER

0-G-491D

2. DOCUMENT DATE (YYMMDD)

920501

3. DOCUMENT TITLE

GLYCEROL, TECHNICAL (HIGH GRAVITY)

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

### 6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED (YYMMDD)

(1) Commercial

(2) AUTOVON  
(If Applicable)

8. PREPARING ACTIVITY

a. NAME

U.S. Army Chemical Research, Development  
and Engineering Center

b. TELEPHONE (Include Area Code)

(1) Commercial

(410) 671-3259

(2) AUTOVON

DSN 584-3259

c. ADDRESS (Include Zip Code)

Cdr, U.S. Army CRDEC

ATTN: SMCCR-PET-S

Aberdeen Proving Ground,

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

Defense Quality and Standardization Office

1000, Falls Church, VA 22041-3466

OVON 289-2340